Public Workshop to Discuss Diesel Off-road Equipment Measure

July 13 and 19, 2005
El Monte and Sacramento, California

Heavy-Duty Diesel In Use Strategies Branch

California Environmental Protection Agency

Air Resources Board

Overview

- **2003 Public Fleet Survey**
- **2005 Off-road Equipment Survey**
- **Field Investigations**
- **Verified Off-road Control Technologies**
- **Update on Other ARB Diesel Control Measures**
- **Regulatory Concepts**
- **Next Steps**

2003 California Public Fleet Survey

California Public Fleet Survey: Methodology and Response Rate

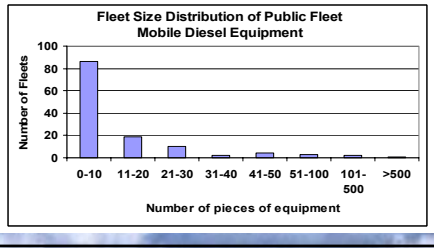
- Conducted 2002-2003 by TIAX LLC for ARB
- Sent to state, county, and city government fleets and special water and irrigation districts
- 31% of fleets surveyed responded
- Highest response rate for utility districts and county fleets

Public Fleet Survey: Data Requested

- Included on-road vehicles and off-road equipment
- Asked for:
  - vehicle type
  - application
  - equipment make & model
  - engine make & model
  - model year
  - horsepower
  - displacement
  - hourmeter reading
  - annual hours use

Public Fleet Survey - Off-road Diesel Fleet Sizes

- Data for 127 off-road fleets
  - 68% with 10 or less pieces
  - 46% with 3 or less pieces



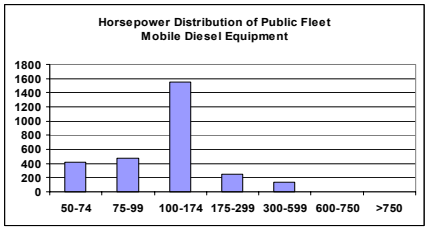
Public Fleet Survey: Equipment Types

- Data on 3,882 mobile diesel off-road machines
- 74% in top 5 equipment types

Equipment Type	Quantity
Loader	1046
Grader	717
Backhoe Loader	503
Mower	305
Tractor	301

Public Fleet Survey: Engine Sizes

- Data on 2,831 mobile diesel off-road engines
- 86% under 175 hp, 55% between 100-174 hp



Public Fleet Survey - Operating Hours

Equipment Type	Annual Operating Hours
Loader	588
Grader	415
Backhoe Loader	405
Mower	569
Tractor	432

Public Fleet Survey - Other Info

- Off-road diesel mobile equipment is on average 16 years old
- Report at http://www.arb.ca.gov/msprog/publicfleets/publicfleets.htm

2005 Off-Road Equipment Survey

Off-Road Equipment Survey: Data Requested

- Fleet sizes
- Equipment types
- Horsepower ranges
- Owned versus rented
- Frequency of rebuild
- Age of engine/equipment when purchased
- Emission controls used and funding received

Off-Road Equipment Survey: Outreach - March-April 2005

- **Phone contacts**
  > 80 phone calls to businesses, manufacturers, trade associations, and government agencies
- **Email notification**
  To > 600 listserve subscribers and > 65 others
- **Workgroup meetings**
- **Meetings with industry associations**
- **Newsletter articles, etc**.

Off-Road Equipment Survey: Responses so Far

- **47 responses received so far**
  - 11 government agencies
  - 11 ski resorts
  - 7 retail/wholesale companies
  - 5 airport or airline fleets
  - 4 construction companies
  - 3 refineries
  - 2 rental companies
  - 2 mining companies
  - 2 other
- **Data on over 4,500 pieces of equipment**

Off-Road Equipment Survey: Additional Responses Desired

- **Additional outreach:**
  - **Letters to 65,000 licensed contractors**
  - **Outreach to State agencies such as California Department of Conservation**
  - **Letter to active mines in California**
  - **Additional outreach to rental companies**
  - **Further work with industry associations, Contractor State Licensing Board, etc.**
- **Other suggestions?**

Field Investigations

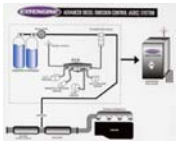
Field Research Conducted

- Construction Companies
- Retrofit Manufacturers
- Equipment Dealers
- Rental Agencies
- Demonstration Projects

Possible Further Field Research- Volunteers Needed

- Construction sites
- Retail
- Rental companies
- Power plants
- Recyclers
- Equipment service and repair shops

Verified Off-road Diesel Emission Control Systems



Verified Devices for Off-road Use

Date Verified	Device	Technology	Application	Model Years
Level 3: > 85% PM reduction or ≤ 0.01 g/bhp-hr PM				
12/13/04	Lubrizol Engine Control System Unikat Combifilter	Actively regenerated diesel particulate filter	Construction, material handling, or cargo handling	1996-2004
Level 2: > 50% PM reduction				
10/29/04	Lubrizol PuriNOx/AZ Purifier/ AZ Purimuffler	Emulsified diesel fuel and diesel oxidation catalyst (DOC)	Port, railway yards, and other intermodal/ freight handling operations	1996-2002
Level 1: > 25% PM reduction				
5/10/04	Lubrizol ECS AZ Purifier/AZ Purimuffler	DOC	Port, railway yards, and other intermodal/ freight handling operations	1996-2002
5/2/03	Donaldson DOC & Spiracle™ closed crankcase filtration system	DOC and crankcase filter	Yard tractors, large lift trucks, top picks, side picks, gantry cranes	1996-2003
1/20/05	Extengine Advanced Diesel Emission Control (ADEC)	DOC and selective catalytic reduction	Rubber tired excavators, rubber tired loaders, rubber tired dozers, utility tractor rigs	1991-1995

Further Information on ARB Verified Systems

- **See website**
  http://www.arb.ca.gov/diesel/verdev/verdev.htm
- **Contact:**

  Shawn Daley, Manager, Retrofit Assessment Section, sdaley@arb.ca.gov

Update on Other ARB Diesel Risk Reduction Measures





Update on Other ARB Diesel Measures

- Transit Agency Fleet Rule
- Solid Waste Collection Vehicles
- Stationary Compression-Ignition Engines
- Portable Engines
- Transport Refrigeration Units
- Commercial Vehicle Idling
- Harborcraft and instate locomotive fuel
- Harborcraft
- Oceangoing ships auxiliary engines
- Cargo handling
- On-road public fleets

Proposed Regulatory Concepts

Regulatory Concepts: Purpose

- Primary: reduce diesel PM emissions from off-road equipment as much as technically and economically feasible in short- and long-term
- Secondary: reduce NOx emissions

Regulatory Concepts: Proposed Applicability

- Applies to sellers, owners, and operators of any mobile diesel-fueled off-road compression ignition equipment over 25 horsepower
- Does not apply to
  - Stationary or portable equipment
  - Equipment used in agricultural operations
  - Equipment at ports or intermodal railyards
  - Locomotives, commercial marine vessels, marine engines, or recreational vehicles

Regulatory Concepts: Proposed Approach for Idling

- Have a policy to reduce unnecessary idling
- Definition of "unnecessary idling" is to be determined

Regulatory Concepts: Proposed Initial Reporting

- **Due mid-2007 for all off-road mobile diesel equipment over 25 hp**
- **Report to ARB:**
  - Owner contact information
  - Equipment and engine information
    - Fleet size
    - Make, model, model year, engine family, engine serial number, horsepower, etc.
  - Emission control system information
  - Type of fuel used
  - Operation information
    - Application, annual hours of operation

Regulatory Concepts: Newly Purchased/ Leased Equipment

- **Non-construction equipment and construction equipment >=175 horsepower:**
  - Meet the final after-treatment based Tier 4 off-road PM standards, or
  - Have the highest level Verified Diesel Emission Control System (VDECS) available on each engine at time of purchase
- **Construction equipment < 175 hp:**
  No requirement at time of purchase

Regulatory Concepts: Proposed BACT Schedule

- **Use Best Available Control Technology (BACT) on each engine as required by the compliance schedule below:**

Group	Engine Model Years	Compliance Phase-in Dates			
		25%	50%	75%	100%
1	Pre-1988	2007	2008	2009	2010
2	1988-1995	2008	2009	2010	2011
3	1996-2002	2009	2010	2011	2012
4	2003-2006	2010	2011	2012	2013
5	2007-2014	Model year (MY) +4	MY+5	MY+6	MY+7

Regulatory Concepts: Proposed BACT Definition

- **Tier 4 or equivalent:**
  - 0.01 g/bhp-hr PM or final after-treatment based Tier 4 PM emission standard; or
- **Tier 2/3 and At Least Level 2 VDECS:**
  - Tier 2 or 3 off-road PM standard or 0.1 g/bhp-hr PM, with the highest level VDECS available
  - If the highest level VDECS is Level 1, then by Dec. 31, 2015, either install a Level 2 or 3 VDECS, or meet the final Tier 4 PM standard; or

Regulatory Concepts: Proposed BACT Definition Cont'd

- **At Least Level 2 VDECS:**
  - Install highest level VDECS available. If the highest level VDECS is Level 1, then by Dec. 31, 2015, either install a Level 2 or 3 VDECS, or meet the final Tier 4 PM standard; or
- **Alternative fuel or heavy-duty pilot ignition engine;** or

Regulatory Concepts: Proposed BACT Definition Cont'd

- **Wait for VDECS or final Tier 4 engine**

  If no engine meeting the final Tier 4 PM emission standard is available, and no VDECS is available, then either:

  –Install Tier 4 engine within 12 months after one becomes available, or

  –If a VDECS is verified for the engine, install it within 12 months. If the highest level VDECS is Level 1, then by Dec. 31, 2015, either install a Level 2 or 3 VDECS, or meet the final Tier 4 PM standard

Regulatory Concepts: Proposed VDECS Failure Approach

- **Within warranty period -- must replace it with same level VDECS**
- **Outside of warranty period -- must replace it with highest level VDECS available for engine at time of failure**

Regulatory Concepts: Proposed Compliance Flexibility

- **Experimental diesel PM control strategy**
- **Engine scheduled to be retired within *x* years**
- **No VDECS commercially available and replacement or repower not commercially feasible**
- **Small fleets**
- **Low-use engines**
- **Early compliance**

Regulatory Concepts: Proposed Record Keeping

- **Owner contact information**
- **Equipment and engine information**
  - Fleet size
  - Make, model, model year, engine family, engine serial number, horsepower, etc.
- **Emission control system information**
- **Type of fuel used, and**
- **Operation information**
  - Application, annual hours of operation

Regulatory Concepts: Proposed Reporting

- **Annual Demonstration of Compliance**
  - **Each year for which fleet has a compliance date**
    - **Provide information required under proposed record keeping**
    - **Identify control strategy implemented for each applicable engine**
  - **Provide justification that no VDECS or Tier 4 engine is available for any engines meeting BACT with the "Wait for VDECS or final Tier 4 engine" option**

Regulatory Concepts: Example - Old backhoe loader

- **90 hp, model year 1987 (Tier 0)**
- **Compliance date = 2007-2010 for model year group**
- **Assume owner wants to meet BACT for this equipment in 2009**
- **Determine what BACT is:**
  - In 2009, Tier 4 engines not available yet
  - Assume use of alternative fuel is not feasible or desirable

Regulatory Concepts: Example - Old backhoe loader Cont'd

- **Determine BACT cont'd:**
  - Assume highest level VDECS available for engine in 2009 and 2015 is Level 1
    - If install Level 1 VDECS, must either install a Level 2 or 3 VDECS or replace with a Tier 4 engine by Dec. 31, 2015
  - Assume Level 2 VDECS available for backhoe loader with Tier 2 engine

Regulatory Concepts: Example - Old backhoe loader Cont'd

- **Follow compliance steps:**
  - **OPTION 1: Retrofit then replace**
    - Install Level 1 DOC in 2009.
    - Replace equipment by 2015 (when 28 years old)
  - **OPTION 2: Repower and retrofit**
    - Repower to Tier 2 in 2009.
    - Install Level 2 VDECS.
  - **OPTION 3: Retire and rent**
    - Retire old backhoe in 2009 and rent one instead

Next Steps and Contacts

Next Steps

- **Workgroup Tuesday, August 30 in Sacramento**
  - Recordkeeping/reporting
  - Regulatory concepts
- **Further workgroup meetings and workshops as needed**
- **To Board for consideration mid-2006**

Contacts

- **Kim Heroy-Rogalski (Staff)**
  kheroyro@arb.ca.gov
  (916)327-2200
- **Jackie Johnson (Staff)**
  jjohnson@arb.ca.gov
  (916) 323-2750
- **Wayne Sobieralski (Field studies)**
  wsobiera@arb.ca.gov
  (916) 323-2791
- **Zerguy Maazouddin (Website and meetings)**
  zmaazoud@arb.ca.gov
  (916) 323-2809
- **Annette Hebert (Chief, Heavy-duty Diesel In-use Strategies Branch)**
  ahebert@arb.ca.gov
  (626)575-6973
- **Kitty Martin (Manager, In Use Controls Section)**
  kmartin@arb.ca.gov
  (916)324-1362

Website:
http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm